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Traffic and Meteorological Influence on Size Segregated Trace Elements at a Kerbside in Dresden, Germany

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PLACE + METHOD

Fig. 1 Kerbside station Dresden, Schlesischer Platz

Place **kerbside** in Dresden: Schlesischer Platz (Fig.1), 55,000 vehicles per day, 8 % heavy duty vehicles

Method
- time: 8/2003 - 8/2004
- sampling: Berner, 24 h, 108 m³, 5 stages, 50 - 10.000 nm
  n = 9 fridays, 2 sundays, 1 New Years Day; 6 summer; 5 winter
- PIXE: Br, Cr, Cu, Fe, Mn, Ni, Pb, Si, Ti and Zn.
  special IC: Ca, K, Mg and Na [1,2]

Crustal enrichment factors (CEFs)
CEFs: dividing average concentration in the stages by their average abundance in the upper continental crust [3].

CRUSTAL ENRICHMENT FACTOR

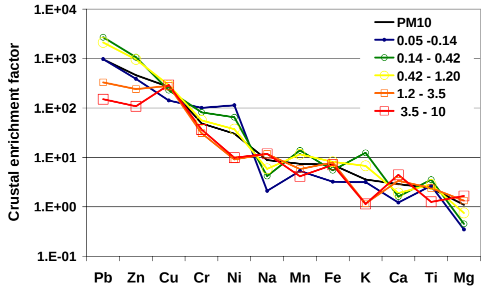

Fig. 2 Crustal enrichment factors, average of all samples without New Years Day

CEFs are calculated **to assess anthropogenic contributions** [3]. CEFs > 10 are commonly interpreted as PM sources different from natural origin. **Si** was chosen as **reference element**, because it is main component of silicate minerals. Also other elements are often used as reference element, like Al [4].

CEFs > 100 **Pb, Zn** and **Cu** in all particle sizes measured (50 nm – 10 µm). **Pb and Zn CEFs** in fine particles 10 times > in coarse particles probably from anthropogenic source traffic. Small particles (to coarse particles) were higher concentrated in Pb and Zn by a factor > 10 probably from small particulates from motor emissions (**lead in petrol**), abrasion of **tailpipe (zinc)**.

WINTER/SUMMER + AIR ORIGIN

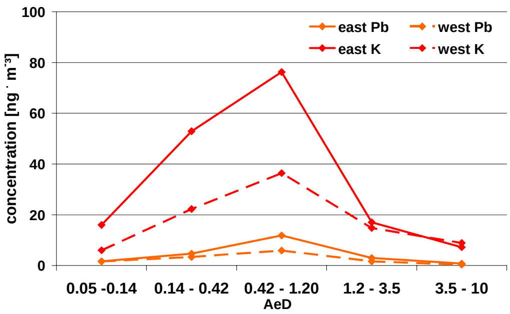

Fig. 3 Air masses from east and west: Concentration of Pb and K

Air mass from east: highest conc. of anthropogenic **Pb** and **K**
Air from the sea: Greatest part of the sea salt elements **Na** and **Mg**
No significant influence of air mass: **Cr, Cu, Zn, Ca, Ti, Si** and **Fe**
Winter higher conc.
>25%: mass, **Pb, Zn, K** (s. Fig 3) and Cr, Ni, Ti
Pb, Zn mainly caused by fine particles
Pb-concentration 2 times higher in winter (P>95 for difference)
no relation summer/winter: **Ca, Cu, Fe, Si, Ti** (P>90%)

NEW YEAR´S DAY

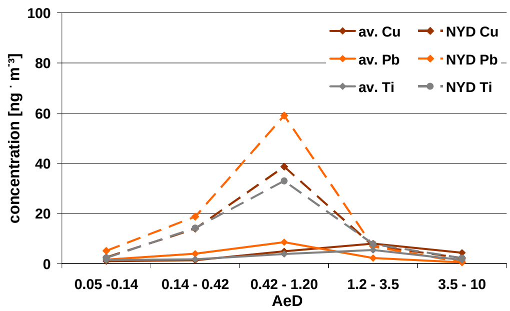

Fig. 4 Concentrations on all stages: New Year´s Day compared to average of year

vehicle numbers 50% of average compared to average of whole year

X-fold higher conc. of daily average on New Years Day > annual average **K** (24.1), **Mg** (6.0), **Pb** (5.3), **Ti** (4.2), **Cu** (3.2)

coarse to fine Cu, Ti, Mg: size distribution maximum **shifted** because of **high concentration of firework** burning products in fine particulate range
+ **less** emissions from **car traffic** of **coarse particles** (Fig. 4)

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SUMMARY

At a kerbside in **Dresden** (**55,000 vehicles per day**, 8 % hdv), n = 12 24h impactor samples (5 stages) were analysed for trace elements by PIXE and IC.

CEFs > 100 were found for **Pb, Zn and Cu** in all particle sizes. Especially Pb and Zn CEFs were 10 times higher in fine than coarse fraction. Probably because of traffic derived emissions.

More Pb was found in **wintertime** and over the whole year with air masses from **eastern** directions.

On **New Year´s Day** conc. **K, Mg, Pb, Ti, and Cu** > **3 times higher** than on average of the year. **Cu, Ti, Mg shifted** max from coarse to fine fraction.